following exceptions and modifications.

- Black rhinos are introduced directly into the smaller front pens, so the larger back pens are not required.
- When a newly-caught black rhino is introduced into the front pen it should be isolated in the front section of the pen for a few days until it has settled down. Thereafter it can use both sections except when it is isolated in one section while the other section is cleaned.
- The corners of the pen should be 'rounded off' by passing poles horizontally across the corners. This is because the animals tend to run around the pen after off-loading, and may injure themselves in the corners.
- A concrete feeding slab should not be provided in the pen as black rhinos may injure themselves against the slab when they are first introduced into the pen.
- The receiving pen design must be used for boma-trained as well as wild-caught black rhinos – i.e., the pens should not be enlarged for wild-caught black rhinos.

5055

Care of the white rhinoceros *Ceratotherium simum* in captivity

P.S. Rogers

The white rhino...

- Is big, strong, dangerous, and unpredictable.
- Is a selective grazer, preferring short, palatable grasses.
- Is a gregarious animal and therefore likes to see and be with other animals of the same species.
- Adapts with great difficulty to captivity, from a stress and nutritional point of view. Younger animals adapt better and quicker than adults.
- Tends to adapt more slowly and less readily to captivity if alone – it is usually with these animals that one runs into problems.
- Is unpredictable from a nutritional point of view – some simply will not eat in captivity for no apparent reason.
- Will try to escape until it resigns itself to captivity and settles down. Almost all escape attempts occur at night. Nights 3,4, and 5 of captivity are most critical in this respect.

Precautions

- It is essential to have a night guard who is in contact with the person in control of the bomas in case of attempted escape by the rhino(s).
- The rhino must be put into a big pen initially to allow it to settle down.
- Antelope cubes should not be fed to rhinos: they may contain cotton seed products. Cotton seed contains gossypol which is potentially toxic to monograstric animals such as the rhino.

- Do not allow visitors until the rhino have settled down. The human element should be restricted to boma personnel only.
- Try, if possible, to capture and accommodate pairs of animals from the same herd: these animals will be more likely to adapt to captivity.

How to care for the captive white rhinoceros

Boma management

When catching animals to place in bomas one would obviously like animals that are going to adapt as soon as possible. This can be very important, bearing in mind the problems one has in getting white rhinos to adapt to captivity. There are three groups of animals that usually adapt fairly readily to captivity:

- A cow with a calf at foot;
- Animals that are running together in the wild;and
- Sub-adult animals, even if they are caught and put on their own.

Most problems are experienced with single, adult animals: the older they are, the more difficult they find it to adapt.

Water is given *ad lib* (bearing in mind that an adult drinks 40–50 litres daily) and the water trough is rinsed out, cleaned, and refilled twice daily. The trough should be disinfected twice weekly with a chlorine compound (e.g., Bacterex K®). Until the animal is eating properly, vitamin B-complex syrup is added to the water as an appetite stimulant at a dilution rate of 250 ml per 50 litres of water. The vitamin B-complex is always added to the water in the evenings, as it is inactivated by sunlight.

It is very important to monitor defaecation from the first day. Rhinos usually defaecate on the first and second days, then stop for four to five days until they start eating again. If the animal only defaecates on the first two days, but not again, Epsom salts can be put in the water from day nine post-capture. Usually these are the animals that are refusing to eat, and it is found that if and when they defaecate they will start eating. Special care must be taken when administering Epsom salts (see below).

The animal should not be moved to the front pens until it is eating well. A spare back pen (for cleaning purposes) is not normally necessary because the animal can be moved forwards into the smaller front pens after 2–3 weeks. This is done by opening the gate between the front and back pens and letting the animal walk in and out of the front pen at will for a day or two. The animal can then be fed in the front pen for a couple of days before closing it in the front pen. This usually does not present problems as the animal is well used to captivity by this stage. Once the animal has settled down in the front pen (3–4 days), the pen cleaning can be commenced on a daily basis.

Because rhinos are so bulky and heavy they are very prone to pressure sores, especially just above the front feet on the fetlock joints and on the hock joints. For this reason a layer of fine river sand (200 mm deep) is put into the front pens. This sand also serves to absorb urine. All the sand should be removed and replaced on a weekly basis. The animal is kept in the front pen for at least 3–4 weeks before it is ready to be transported to its final destination (a total of at least six weeks of boma training).

Deworming is not done by us as it is possible that a symbiotic relationship may exist between the internal parasites and the rhino. In the similar digestive tract of the zebra it seems that the nematode 'parasites' aid in the digestion process.

Off-loading

Ensure that the water trough is empty, as a sedated animal could drown in it. Water should only be given once the animal has fully recovered from the effects of the drugs.

When the animal is off-loaded at the bomas it is usually still very groggy and remains so for at least six hours. If it is very hot, the animal may be hosed down once off-loaded into the pen.

The animal often lies down after off-loading (white rhino only). This is acceptable as long as the animal doesn't lie down for longer than twenty minutes at a time (to avoid neuromuscular damage to the hind legs). It is advisable to have a staff member equipped with a long-handled cattle prodder attending to the animal until it recovers. Sometimes the animal leans against the poles of the boma. Care must be taken to ensure that the animal does not smother itself, especially if it is in a corner.

Crate training

Once in the small pens, the animal is fed on a concrete slab for about four days. From then on the crate is opened and the feed is placed at the opening to the crate. The feed is gradually placed deeper and deeper into the crate until the animal's whole body is inside the crate when feeding (see Plate 21). This crate is similar to the one in which the animal will travel to its final destination, and this procedure is carried out to get the animal used to a very confined space.

The rhino should be eating all its food in the crate for at least 14 days before translocating it to its final destination.

Feeding

Because it is so difficult to get captive white rhino to eat, highly palatable grasses such as *Cynodon dactylon* (quickgrass) and *Panicum spp.* (buffalo grass) must be given if possible. These species can be found growing in shady, damp areas and on river banks. Freshly cut kikuyu grass, if available, is also very good.

Freshly cut green grass is fed twice daily under the feeding roof on the concrete slab; old grass is removed after each feed. It may be found that the animal starts nibbling from day three or day four, and only starts eating well from about day seven. *Eragrostis tef* can then be mixed with the natural grass and increased so that by day 12 the rhino is eating teff only. The vitamin B-complex supplement in the water can then be withdrawn. At this stage start mixing in lucerne up to a maximum of about 10% of the total hay diet; anything higher than this can lead to loose stools and even diarrhoea. The time taken to reach this stage will vary from one animal to the next.

It is essential to feed the best quality teff and lucerne available in order to get the animal to eat. This feed must be kept dry. The teff and lucerne must be checked for mould – this can lead to colic, diarrhoea, or even death. Rodent control is essential – rats can carry *Salmonella*, a bacterium that causes a severe diarrhoea in rhino.

Rhinos should be fed twice daily throughout their period in captivity. Once eating well an adult should eat three-quarters to one bale of hay per day. Big bulls may eat up to one-and-a-half bales. When the animal is eating well horse cubes can be sprinkled on top of the feed, increasing gradually to about 2,5 kg twice daily for adult animals.

Occasionally (10–20% of cases), an animal refuses to feed at all. A good rule of thumb is that if the animal has not taken food by day ten it should be released by simply opening the gate. It is important that the bomas be situated where the animal can simply be released in this fashion. To have to dart an animal, which has not eaten for ten days, in order to load it again for translocation to a suitable release site could be a very risky and stressful procedure. It must be emphasized, however, that ten days is a rough guideline only. Some animals lose condition very rapidly and might have to be released after only six days, whereas others might be able to last longer than ten days (although this is very risky). Inclement weather, for example, can cause a perky animal that has not eaten for ten days to succumb overnight. Experience has shown that it is always better to release the animal sooner rather than later.

Animals that are not in good condition when they reach the bomas will obviously have to be released sooner if they do not eat. An early visible guide to the condition of a rhino is the appearance of skin folds on the lower side of the abdomen just in front of the hind legs, extending forwards towards the thorax. These folds are only visible in animals that are in poor condition. They start off short and shallow, just in front of the hind legs, later increasing in length and thickness as the animal's condition worsens.

If a rhino is refusing to eat and there are others in the boma that have been there for a while and are eating well, one can try mixing them. This often has the desired effect and the animal starts eating immediately. One must monitor the animals closely for a while after mixing them to make sure that they do not fight. This measure works particularly well where younger animals are involved: it is when older animals are mixed that fighting may occur. Some operators report using diazepam (Valium®) as an appetite stimulant. We have tried it on two occasions without success (10 mg IM), but it is definitely worth further experimentation. One of the animals drank about 50 litres of water after injection, but still did not eat.

Long-acting tranquillizers

Perphanazine enanthate (Trilafon®) was used on isolated white rhinos in 1991 with promising results. However, it was used again in 1992 on a group of 19 animals (adults 100 mg, subadults 50 mg) with poor and inconsistent results. Most, but not all, of the animals were calm for the first 7–10 days and then some of them became very wild again. Some of the animals appeared to be in a trance for longer than 10 days and were not interested in eating. One of these animals stood with its head in the feed without eating whilst its calf ate right next to it. Six animals out of this group had to be released because they did not eat, whereas normally only one or two would have had to be released. In my opinion, therefore, it is not advisable to use this drug routinely in white rhinos. If tranquillization should become necessary, however, the above doses should be adequate.

Clinical problems

Clinical problems should, where possible, be solved without resorting to immobilization. Immobilizing a rhino in a boma can be a risky procedure, depending on the condition of the animal. If immobilization does become necessary, use one third of the dose of opioid drug

used at capture. Inclusion of a tranquillizer in the dart is not necessary. The animal must be monitored closely from the time of darting until the time it is given the antidote, and one must be prepared and equipped to give emergency treatment if necessary.

Wounds

Superficial wounds inflicted during capture can be treated with an antibiotic spray. Superficial wounds acquired in the bomas can be treated with a 1:500 acriflavine solution administered using a pressurized garden spray. This is an antiseptic solution that promotes scab formation. More serious, deeper wounds can be treated with iodine antiseptic solution (Provodine®) followed by acriflavine glycerine (1:1000). Acriflavine glycerine is also an antiseptic solution that stimulates granulation (healing), gets rid of dead tissue, and keeps the wound moist. Both the iodine and the acriflavine glycerine can be administered using a garden spray. The acriflavine glycerine is a bit thick, so it is mixed with a small amount of acriflavine solution so that a greater range may be attained when spraying the animal. Once the wound shows signs of healing well, the acriflavine glycerine is continued without the iodine, until the wound is shallow enough to use acriflavine solution on its own.

Septic wounds are first sprayed with 20% hydrogen peroxide. This is allowed to react with the wound surface for a few minutes before rinsing off with water. It may be necessary to repeat the process. Once the wound is cleaned, it is sprayed with iodine and acriflavine glycerine. This process must be carried out daily – even twice daily in severe cases.

If considered necessary, antibiotic injections can be given using 20 ml darts (Telinject®). Long-acting penicillin (e.g., Compropen®) can be given every 2–3 days, or an antibiotic with a broader spectrum (e.g., Potencil®) can be given daily. It is preferable to give these injections in the neck. The darts can be left to fall out on their own, or can removed with a long piece of wire.

Occasionally, wounds may become infested with blowfly maggots, especially in summer. A tell-tale sign is the presence of a little hole with blood or serum oozing from it. This situation is easily remedied by spraying a solution of diazinon (Dazzel®) onto the wound at a dilution rate of 6 ml Dazzel® per litre of water. It must be borne in mind that this is an organophosphate, and is thus extremely poisonous: for this reason all food and water should be romoved from the pen before administering this medication. One treatment is usually sufficient.

The front horn may occasionally be broken off in the crate or when an animal charges the walls of the boma. The horn usually breaks off at the base. A big, bleeding wound results, but it is not as bad as it looks. The wound will dry up and heal on its own, but it is better to spray it with acriflavine solution to keep it clean and to encourage scab formation.

Pressure sores can be avoided by good management (see earlier). They are treated in exactly the same way as other wounds, but the underlying cause must be eliminated.

Constipation

This condition is seldom seen in captive rhinos. It is usually associated with an animal that is not eating. Symptoms that may be seen are loss of appetite, listlessness, very little or no dung in the boma (the foregoing symptoms can also be normal in a newly caught animal), very hard dung, straining, and rapid breathing due to abdominal discomfort. Constipation is more likely to be seen in animals that are not in good condition anyway due

to poor nutrition (e.g., during a drought when the grass is likely to be more difficult to digest than normal).

Magnesium sulphate (Epsom salts) is dissolved in 50 l of drinking water: 50 g for a juvenile, 100 g for a sub-adult, 200 g for a young adult, 400 g for an adult, and 500 g for a big bull. This may be repeated after 36–48 hours if necessary. Care must be taken when giving Epsom salts as one does not want to cause diarrhoea. Fresh rhino dung may also be put into the pen to try to stimulate the animal to defaecate. Very occasionally it may be necessary to immobilize the animal and remove the faecal balls (Flamand, pers. comm.).

Diarrhoea

Diarrhoea is usually due to either a dietary problem or an infection. If it is a dietary problem, there could be one of two causes. Initially diarrhoea occurs while the animal is adapting to its new diet: this is transient. If diarrhoea occurs after the animal has been in captivity for some time, it is usually because it has taken in too much lucerne or cubes. Withdrawal of these feeds for a few days usually alleviates the problem.

It is advisable to treat the diarrhoea symptomatically. Kaolin is introduced to the drinking water: 50 g for a juvenile, 250 g for a sub-adult, and 500 g for an adult. Kaolin does not suspend readily, and the water must be agitated frequently: while its efficacy under these circumstances may be limited, there are few alternatives. An electrolyte/glucose supplement (e.g., Entersol®) should also be added to the water.

If a bacterial infection is involved, it is usually *Salmonella typhimurium*. This is usually fatal. *Salmonella* is thought to be brought into the bomas by carrier animals (as in horses). The stressful conditions under which the animal finds itself leads to a drop in its resistance, and the animal can then develop a severe diarrhoea. Another possibility is that the feed might be contaminated by carrier rats and mice that defaecate or urinate on the feed.

If *Salmonella* is suspected or diagnosed, antibiotics such as furazolidone can be introduced into the water (e.g., Biolyte® diarrhoea powder, which also contains electrolytes and glucose). As the antibiotics used in the water are poorly absorbed from the gut, and because the animal may die from a septicaemia, it is necessary to give parenteral antibiotics (e.g., Potencil®) as well. If the animal stops drinking and/or becomes recumbent, it can be put onto a drip and given antibiotics, vitamins and spasmolytics. The prognosis in these cases is very poor.

Unfortunately, *Salmonella* diarrhoea is fairly common in rhinos in pens. There is a vaccine available for *Salmonella typhimurium*, but it is not effective in rhinos. Research is being conducted on a new live vaccine and, at the time of writing, the preliminary results appear encouraging.

Once *Salmonella* has been diagnosed, the affected pen should be sterilized immediately.

- Remove all the soil in the pen to a depth of at least half a metre.
- Spray the surface with a solution of 2% formalin.
- Fill up the hole with fine river sand.
- Disinfect all the poles and the water trough.

When an animal develops diarrhoea, for whatever reason, an attendant must be set aside to look after this animal only. This person sees to the animal's feed and water needs, and does not go near any of the other rhinos. Scrubbing and cleaning equipment must be used

only in the infected pen, and must be sterilized every time after use. The attendant should wash his hands with an antiseptic soap each time after working in the pen, and should also wear gum boots that are disinfected after use. He should also wear an overall every time he works at the pen, leaving both the overall and gum boots there. The overall should be changed daily.

Colic

Colic is occasionally seen in rhinos in captivity. Clinical signs of colic in the rhino include rolling, 'crying', continual changes in position, repeated standing and lying down, and distress. Probable causes are mouldy feed, change in diet, etc. A single intramuscular injection of a spasmolytic (e.g., Finadyne[3]) is usually effective. Use 20 ml Telinject[3] darts. An abscess may develop at the injection site.

Pneumonia

Pneumonia is uncommon in captive rhinos: it usually occurs only in animals that are not in good condition, often following a cold, wet spell. This is where shelter from the elements, especially rain, is very important. A cold animal is bad enough but a cold, wet animal is a dangerous combination. Pneumonia is a very difficult condition to diagnose by just looking at an animal. Listlessness and laboured, often noisy breathing, occur. The animal must be darted with antibiotics (e.g., Potencil[3]) and vitamin B-complex syrup should be included in the drinking water.

Fly and tick worry

This can pose a problem in summer. Flies tend to sit on wounds and generally irritate the animal. Bayticol[5], which is a safe, synthetic pyrethroid, can be sprayed onto the animal weekly. This is effective against both stable flies (*Stomoxys spp.*) and ticks.

Abscesses

Abcesses are seldom seen in rhinos. Abscesses that do develop are usually as a result of a dart wound or injection. Because it is not possible to lance an abscess without immobilizing the animal, the abscess is usually left to rupture on its own. It is then treated as an open wound (i.e., hydrogen peroxide, iodine, acriflavine glycerine, etc.) The wound usually clears up fairly quickly. If the opening continues to ooze it may be necessary to immobilize the animal and flush the abscess. In such cases a long-acting antibiotic should also be used.

Eye infections

Eye infections may be caused by dust or a blow to the eye. An active infection is characterized by a yellow-green, thick discharge, whereas physical trauma is characterized by a watery, clear discharge. Try to wash away the debris with water. Depending on how tame the animal is, it may be possible to treat the eye with an antibiotic ointment: Orbenin OPH[8] (every 48 hours), Opchlor Vet[5] (3–4 times daily), or Terracortril[5] (twice daily). The latter contains cortisone, so one must make sure that there are no corneal lesions before administering it. The animal will not usually be tame enough to allow administration of an ointment. An iodine based spray is very effective in such cases. Examples include Vidine[2] and Oberdine[9] wound, eye and footrot spray. These antibacterials can be administered from a distance of 10–20 cm. They should be administered at least twice daily until recovery.

Foot infections

These occur when bacteria invade wounds or cracks on the feet, and are usually only found when the animals are kept under wet, dirty conditions. Hydrogen peroxide, iodine, and acriflavine glycerine should be applied as described earlier. If the animal will not lie down long enough for the full treatment, try to ensure that at least the iodine and acriflavine glycerine are applied. Failing this, alternate treatment with these two drugs. It may be necessary to administer antibiotics (e.g., Compropen[9] or, in severe cases, Potencil[5]).

Personal communication: Dr J.R.B. Flamand, Box 456, Mtubatuba, 3935 RSA.

Chemical capture of the black rhinoceros *Diceros bicornis*

P. S. Rogers

Also see *Chemical Capture of the White Rhinoceros*, this Section.

The black rhino...

- Is very similar to the white rhinoceros, except that:
  - It favours dense bush;
  - It is not usually gregarious;
  - It is by nature more aggressive and belligerent, and is potentially dangerous when approached on the ground; and
  - It reacts better than the white rhino to the drugs used in the anaesthetic cocktail.
- If disturbed upon approach, and after darting, will either become aggressive and charge the marksman, or alternatively will run off and seek shelter in a dense thicket.

Precautions

The same precautions that apply to white rhino capture apply here. There are some additional precautions to bear in mind.

- Be aware that because azaperone, and not hyoscine, is used in the anaesthetic cocktail, the black rhino's vision is not as severely impaired as that of the white rhino.
- Appropriate precautions should always be taken to ensure that there are no other rhinos nearby when working on an immobilized animal. Because they are not usually gregarious, it is seldom that the helicopter has to chase other family members away. This is not always the case however – for example, a cow/calf combination where only the calf is being captured.
- Because black rhinos usually become recumbent in thick bush, be sure to check that there are no obstacles impeding the immobilized animal's breathing.
- Always cut off the tip of the anterior horn. Black rhinos are often very aggressive towards each other on release from the bomas at their final destination.